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Underpinnings of CP-Violation at the High-energy Frontier

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I will present a general analysis for the discovery potential of CP-violation (CPV) searches in scattering processes at TeV-scale colliders in an effective field theory approach. The CP-violating sector of the SMEFT framework will be examined in some well motivated limiting cases, based on flavour symmetries of the underlying heavy theory. In particular, we show that under naturality arguments of the underlying
new physics (NP) and in the absence of (or suppressed) flavour-changing interactions, there is only a single operator which alters the top-Yukawa coupling, that can generate a non-negligible CPV effect from tree-level SMxNP interference terms. We find, however, that CPV from this operator is expected to be at best of O(1\%) and, therefore, very challenging if at all measurable at the LHC or other future high-energy colliders. We then conclude that a potentially measurable CPV effect, of O(10\%), can arise in high-energy scattering processes ONLY if flavour-changing interactions are present in the underlying NP; in this case a sizable CPV effect can be generated at the tree-level by pure NPxNP effects and not from SMxNP interference. I will provide several examples of CPV at the LHC and at a future e^+e^- collider to support these statements.

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